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Environmental and Operational End-Year Data Report for the OU 7-08 Organic Contamination in the Vadose Zone Project – 2003

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Idaho Completion Project

Bechtel BWXT Idaho, LLC

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ABSTRACT

Since January 1996, Operable Unit 7-08 has been using soil vapor extraction to remove organic contamination from the vadose zone outside the disposal pits and trenches in the Subsurface Disposal Area within the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory. The vadose zone contains volatile organic compounds, primarily in the form of organic vapors, that have migrated from buried waste in the pits and trenches.

This report documents operational and sample data for Operable Unit 7-08 recorded between July 1 and December 31, 2003. During that time, approximately 3,437 kg (7,578 lb) of total volatile organic compounds were removed from the vadose zone and oxidized through thermal or catalytic processes. Vapor vacuum extraction with treatment Units A and D removed approximately 1,421 kg (3,132 lb) and 2,017 kg (4,446 lb), respectively.

Carbon tetrachloride is the largest contributor to the volatile organic compound mass removal, representing 56% of the total for this operating cycle. Isoconcentration plots of current CCl_4 vapor data, at approximately 21 m (70 ft) deep, indicate an increase since January 2002, but an overall decrease in the areal extent of the plume when compared to data taken before operations at the same depth. Current increased levels of CCl_4 are likely the result of a rebound response when Units A and B were shutdown. The vapor data generally indicate a decrease in the CCl_4 concentration at the center of the plume when compared to data taken before operations.

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ACRONYMS

B&K	Brüel and Kjær
DQO	data quality objective
INEEL	Idaho National Engineering and Environmental Laboratory
OCVZ	organic contamination in the vadose zone
OU	operable unit
RPD	relative percent difference
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
VOC	volatile organic compound
VVET	vapor vacuum extraction with treatment

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1. INTRODUCTION

1.1 Purpose

This report documents operational activities of Operable Unit (OU) 7-08 through the end-year reporting period for Calendar Year 2003 (i.e., July 1 through December 31, 2003). Operable Unit 7-08 is defined as the Organic Contamination in the Vadose Zone (OCVZ) Project at the Subsurface Disposal Area (SDA) within the Radioactive Waste Management Complex (RWMC) at the Idaho National Engineering and Environmental Laboratory (INEEL).

Operable Unit 7-08 extends from land surface to the top of the Snake River Plain Aquifer, approximately 177 m (580 ft) beneath the RWMC. Disposal pits and trenches within the SDA are not part of OU 7-08. The vadose zone contains volatile organic compounds (VOCs) primarily in the form of organic vapors that have migrated from the waste buried in the SDA. Figure 1 is a map of the INEEL that shows the location of the RWMC. Figure 2 is a map of the RWMC, which comprises the SDA.

Operable Unit 7-08 is the designation recognized under the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991) and the "Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)" (42 USC § 9601 et seq., 1980) for OCVZ remediation beneath the RWMC. In accordance with the *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area* (DOE-ID 1994) (hereafter referred to as *OU 7-08 Record of Decision*), the selected remedy for OCVZ consists of (1) extraction and destruction of organic contaminant vapors present in the vadose zone and (2) monitoring of vadose zone vapors in the Snake River Plain Aquifer beneath and near the RWMC.

1.2 Background

To implement the selected remedy described in the *OU 7-08 Record of Decision* (DOE-ID 1994), three vapor vacuum extraction with treatment (VVET) units with recuperative flameless thermal-oxidation systems were installed within the boundaries of the SDA and began operating in January 1996. Two of the flameless thermal-oxidation-system units (designated as Units A and B) extracted and treated vapors from two extraction wells, and one flameless thermal-oxidation-system unit (designated as Unit C) extracted and treated vapors from one extraction well. During the spring of 2001, Unit C was decommissioned and removed from the SDA. Unit D, an electrically heated catalytic oxidizer, was installed at the previous Unit C location. In February 2003, Unit B was decommissioned, followed by Unit A in October 2003. Units E and F, both electrically heated catalytic oxidizers, have replaced Units A and B and will become operational in spring 2004.

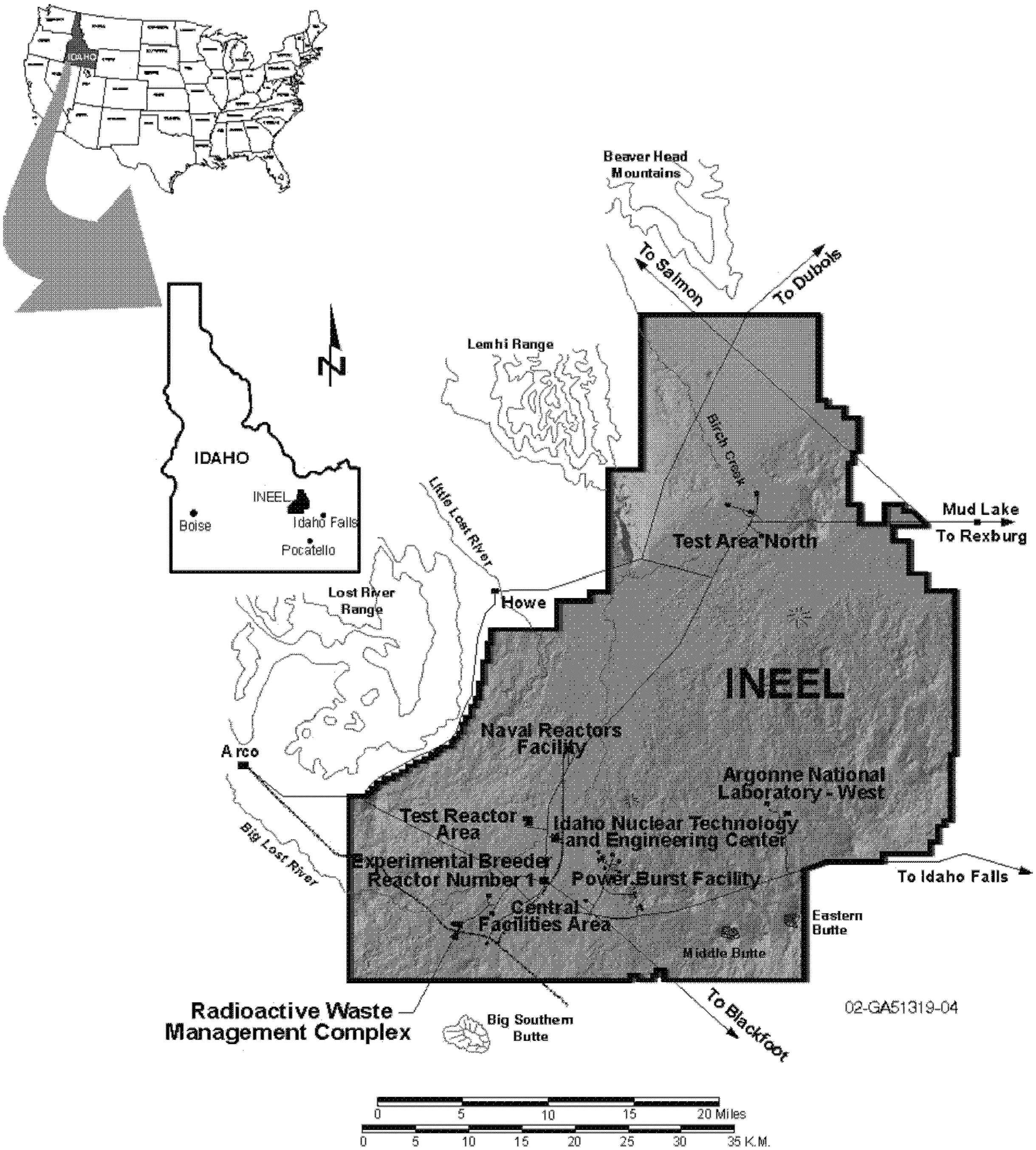

Figure 1. Map of the Idaho National Engineering and Environmental Laboratory showing the location of the Radioactive Waste Management Complex and other major facilities.

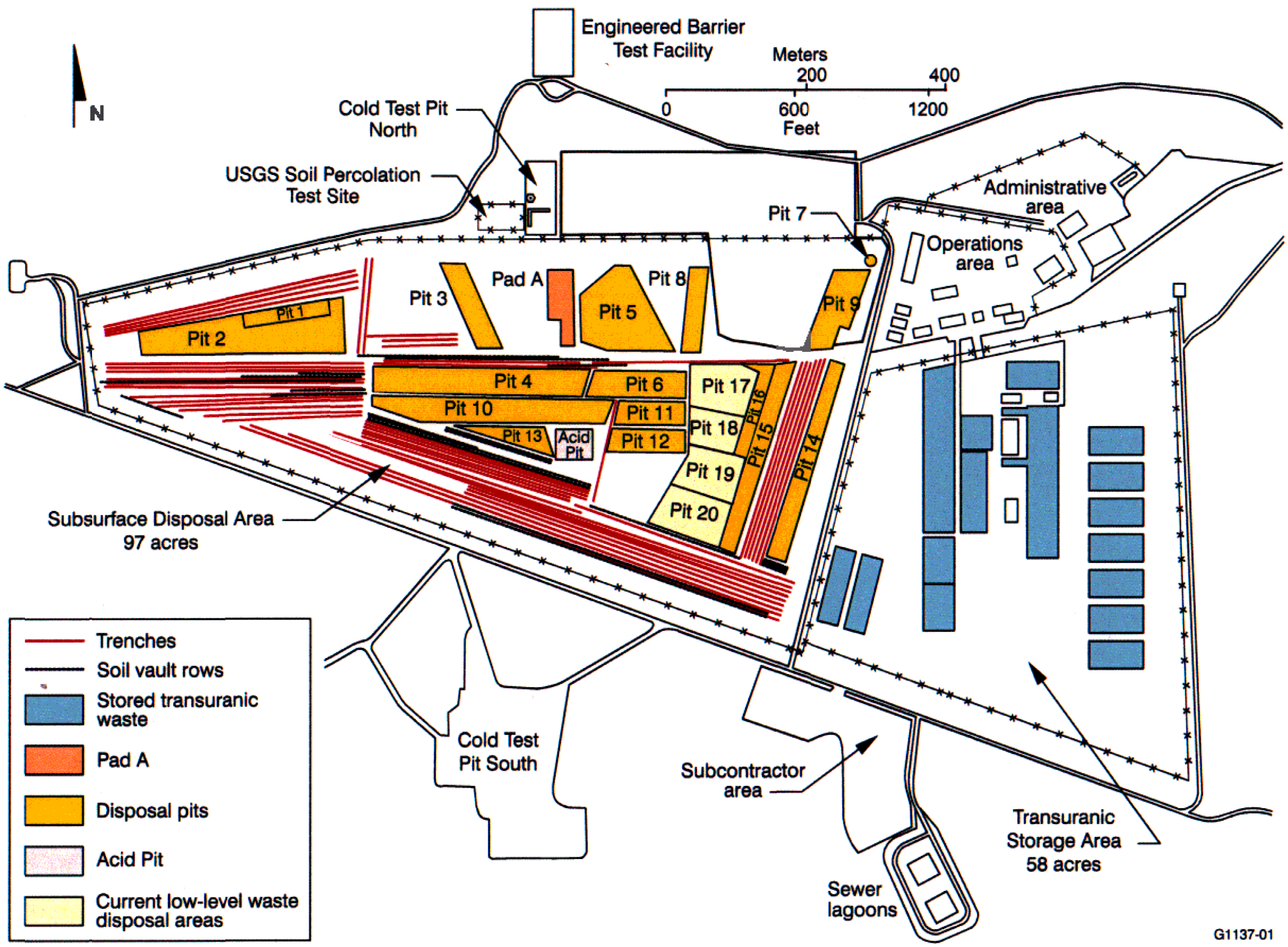

Figure 2. Map of the Radioactive Waste Management Complex showing the location of the Subsurface Disposal Area.

In 1994, 15 new vapor extraction and monitoring wells were installed in or next to the SDA. In addition, one extraction well (Well 8901D) and five monitoring wells (Wells D02, 8801, 8902, 9301, and 9302) were incorporated for extracting and monitoring VOC vapors. In 2000, Wells DE-1 and M17S were installed to provide additional monitoring. In 2001, Wells 6E and 7E were installed as extraction wells. During late 2002, Wells SE6, IE6, DE6, SE7, IE7, DE7, SE8, IE8, and DE8 were drilled and set with casing and vapor ports. Wells SE3, IE3, DE3, IE4, and DE4 were set in early 2003. Additionally, Wells 1835 (also known as M10S-R) and 1898 were installed with vapor ports during 2003. All boreholes installed by OU 7-08 during Fiscal Year 2003 were completed as extraction and/or monitoring wells.

2. DISCUSSION OF ENVIRONMENTAL AND OPERATIONAL SAMPLE DATA

To monitor effectiveness of the VVET system, vapor samples are collected from monitoring wells and at the inlet of VVET units, then analyzed using a Brüel and Kjær (B&K) photoacoustic multigas analyzer. This section presents a discussion of the following data quality and monitoring objectives for the project:

- Precision
- Accuracy
- Completeness
- Comparability
- Mass removal
- Spatial and temporal distribution of VOCs in the vadose zone
- System optimization and maintenance.

2.1 Precision

Precision is the ability of a measurement to be consistently reproduced. Precision pertains to the quality and reliability of the field data obtained by the project. Two types of sample replicates were analyzed to ensure the quality of collected data. The two classifications of replicates were field repeat and field duplicates. A field repeat is a repeat analysis of a field-collected sample used to test the precision of the analytical instrument. A field duplicate is a separate sample collected from the same location at the same time as the original sample. This duplicate sample is used to test the precision of the field collection techniques. Duplicate imprecision may also be an indication of failure to properly operate analytical equipment or adhere to analyzer procedural requirements. A measurement of precision was determined by calculating the relative percent difference (RPD) for both the field duplicates and the field repeats. A goal was set to achieve precision of less than 30% RPD for all replicate samples (INEEL 2002). The RPD is calculated as shown in Equation (1) where C_1 and C_2 are the respective analyte concentrations in a replicate sample pair.

$$RPD = 100 \times \frac{\left(\left|C_1 - C_2\right|\right)}{\left(\frac{C_1 + C_2}{2}\right)} \quad . \tag{1}$$

Samples were analyzed, as in previous operating cycles, using a B&K gas analyzer. Sample precision of duplicate or repeat samples of chloroform, 1,1,1-trichloroethane, tetrachloroethene, trichloroethene, carbon tetrachloride (CCl_4), and total VOCs was recorded (see Appendix A). A total of 127 sample replicates (duplicate and repeats) was collected during the operating cycle, resulting in a total of 635 possible component pairs. Of the 635 sample component pairs, 572 exhibited RPDs of less than 30%. Of the 63 sample component pairs that exceeded 30% RPD, 13 were the result of measured analyte concentrations below the 1-ppmv B&K detection limit. Measurement precision decreases as sample concentrations approach the 1-ppmv B&K detection limit, resulting in the observed increase in RPD. For any samples resulting in a negative value, the concentration was assumed to be zero. Over 97% of all repeat component comparisons resulted in an RPD of less than 30%. Duplicate component comparisons resulted in 80% with an RPD of less than 30%. While these results provide strong confidence in the analytical instrument's precision, they also reveal the need for some improvement in the precision of field collection techniques and adherence to analyzer procedure requirements**.**

2.2 Accuracy

Accuracy relates to the extent to which instrument readings represent true values and are free from error. Instrument accuracy was tested using various sample standards before analyzing each sample set during the end-year 2003 operating period. Standards (i.e., premixed gas samples at verified concentrations) were purchased at concentrations of 1, 5, 100, 500, and 1,000 ppmv. Actual constituent concentrations of each of the standard gasses are detailed in Table 1. These standard gasses were analyzed before each set of vapor samples was analyzed to quantify and validate instrument performance.

Table 1. Standard gas compositions.

Constituent	1-ppmv Standard (ppmv)	5-ppmv Standard (ppmv)	100-ppmv Standard (ppmv)	500-ppmv Standard (ppmv)	1,000-ppmv Standard (ppmv)
Chloroform	1.02	4.9	100.25	498.60	—
1,1,1-trichloroethane	1.03	5.0	99.81	497.46	—
Tetrachloroethene	1.04	4.9	100.06	498.25	—
Trichloroethene	1.03	4.9	100.23	498.57	—
Carbon tetrachloride	1.01	5.0	98.55	498.87	1,001.2

Analytical results for the 1-ppmv CCl_4 standard sample were measured with reported concentrations from 85 to 148% (see Section 2.2.1) of the known concentration. Analytical results for 12% of the 1.01-ppmv CCl_4 standard samples exceed the prescribed acceptable ±20% error bound limit. Analytical results for the 5-ppmv CCl_4 standard samples ranged from 86 to 156% of the known concentration. Analytical results for 6% of the 5-ppmv CCl_4 standard samples exceed the prescribed acceptable ±20% error bound limit. Analytical results for the 100-ppmv CCl_4 standard samples ranged from 81 to 90% of the known concentration. Analytical results for the 500-ppmv CCl_4 standard sample were measured with reported concentrations ranging from 69 to 90% of the known concentration. Analytical results for 10% of the 500-ppmv CCl_4 standard samples exceed the prescribed acceptable ±20% error bound limit. The 1,000-ppmv CCl_4 standard samples had results that ranged from 86 to 98% of the known CCl_4 concentration. Analytical results have fallen within the acceptable ±20% error bound limit of known CCl_4 concentrations 94% of the time for all standard samples. Accuracy of the B&K gas analyzer is illustrated in Appendix B.

2.2.1 Analytical Performance Enhancement

The project has been vigilant to maintain and improve the quality of data collected and the confidence with which these data can be used given the limitations of the analyzer. Better quality has been achieved in analytical performance through better sampling and analysis procedures including sample collection, handling and storage procedures, and calibration and performance optimization of existing analytical equipment.

2.3 Completeness

A total of 1,008 samples was targeted during the end-year 2003 period of operation. This total included 876 well samples, 88 well repeats, and 44 well duplicates. Ultimately, 983 (98% of target) samples were analyzed and recorded. This included 856 well samples, 75 well repeats, and 52 well duplicates. Repeats and duplicates were targeted for analysis rates of at least 1:10 and 1:20, respectively, in accordance with the *Data Quality Objectives Summary Report for Operable Unit 7-08 Post-Record of Decision Sampling* (INEEL 2002) (hereafter referred to as OCVZ Data Quality Objective [DQO] report). Factors affecting well completeness include inaccessibility to well locations and sample-bag failure. For example, a few wells were inaccessible during the winter months because of snow covering the access roads.

Percent completeness of the sampling and analytical data was calculated for this operating cycle using Equation (2). Completeness of sampling is detailed in Table 2 for monthly well monitoring and duplicate and repeat samples. Because samples are considered noncritical during VVET operations, a target for completeness of 90% is designated by the OCVZ DQO report.

$$\%complete = 100 \times \frac{(number\ of\ samples\ analysed)}{(number\ of\ samples\ targeted)} \quad . \tag{2}$$

Table 2. Completeness of well sampling.

Type	Samples Targeted	Samples Analyzed	Percent Complete
Monthly monitoring samples	876	856	98%
Monthly duplicates	44	52	118%
Monthly repeats	88	75	85%
Total samples	1008	983	98%

2.4 Comparability

The data set included in this report (i.e., July, 2003 through December 31, 2003) is comparable to that of previous data sets because the same field collection technique, field procedures, sample-handling methods, and quality assurance and quality control procedures were applied. Analytical detection limits are similar because the same field instrumentation was used (i.e., B&K gas analyzer).

On a monthly basis, samples were collected from 135 vapor ports within and in the immediate vicinity of the SDA boundary to monitor concentration trends in the VOC plume. On a quarterly basis, 33 additional ports outside the SDA boundary were sampled to monitor the vapor concentrations at various locations ranging from just outside the fence up to 2,774 m (9,100 ft) from the VOC source area. Beginning in September 2003, two additional vapor ports were added to the list of monthly sampling ports with the installation of Well M10SR. Another well, designated as Well 1898, added three ports to the list of monthly sampling ports beginning in November 2003. Vapor port sampling and analyses were completed in accordance with the OCVZ DQO report.

The analytical results for four monthly vapor port sampling events (July, August, October, and November 2003) and two quarterly sampling events (July and December 2003) are included in Appendix F.

2.5 Mass Removal

The VOC concentrations of process samples taken from ports on the inlet lines (downstream of the ambient air intake valves) to the VVET units were used to calculate mass-removal rates. Samples were taken daily during the normal operations workweek (i.e., Monday through Thursday), and the results were averaged between sampling events. Results show that approximately 3,437 kg (7,578 lb) of total VOCs were removed during this operation period. Units A and D removed approximately 1,420 kg (3,132 lb) and 2,017 kg (4,446 lb), respectively. Actual operating hours and average unit operation parameters (i.e., flow rate, pressure, and temperature) were used for the mass-removal calculations (EDF-2157).

Analyte mass-removal estimates for July through December 2003 for Units A and D are presented in Appendix C, Tables C-1 and C-2, respectively. Shown graphically in Figures C-1 and C-2 (see Appendix C) are process sample (i.e., inlet) CCl_4 concentrations for Units A and D, respectively. For comparison, Figures C-3 and C-4 (see Appendix C) graphically present mass removal estimates for each analyte during this reporting cycle and since January 1996, respectively. Analyte mass removal estimates for each operating cycle since January 1996 are provided in Table C-3 (see Appendix C). As shown in this table, CCl_4 is the largest contributor to the mass removal of VOCs with 57% of the total occurring from July through December 2003 and 62% of the total occurring since January 1996.

2.6 Spatial and Temporal Distribution of Carbon Tetrachloride in the Vadose Zone

The spatial and temporal distribution of CCl_4 concentration in the subsurface is graphically presented in Appendix D. The figures in Appendix D represent a horizontal cross section of the distribution of the CCl_4 concentration in the SDA at approximately 21 m (70 ft) below ground surface. Concentration values from five different sampling events were used to prepare the plots before starting remedial action in January 1996, January 1998, January 2000, January 2002, and December 2003. The CCl_4 concentration distribution was kriged[a] using an Environmental Visualization System software program. Plots of current CCl_4 vapor data, at approximately 21 m (70 ft) deep, indicate an increase since January 2002, but an overall decrease in the areal extent of the plume when compared to data taken before operations at the same depth. Current increased levels of CCl_4 are likely the result of a rebound response when Units A and B were shut down. The vapor data generally indicate a decrease in the CCl_4 concentration at the center of the plume when compared to data taken before operations.

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a. Kriging is a method of linear regression that takes into account the spatial relationship of a series of points. In this case, concentrations are estimated between actual measured data points, providing insight into what the actual concentration profile might look like at any horizontal level in the contamination zone.

2.7 System Optimization and Maintenance

This section documents treatment system corrective maintenance modifications, preventive maintenance, configuration management, component calibration activities, installation of Unit F, and radiological filter sampling and analysis at the inlet to VVET units completed from July through December 2003. Preventive maintenance activities were completed in accordance with the OCVZ VVET preventive maintenance schedule (McMurtrey and Harvego 2001).

2.7.1 Corrective Maintenance

Corrective maintenance activities are required in response to an event where systems fail or break down. Work is performed in accordance with the INEEL "Integrated Work Control Process" (STD-101). Because of effective preventive maintenance and design, corrective maintenance on the units was required only three times during the end-year 2003 reporting cycle, as described below.

October 22, 2003—Corrective, planned maintenance on Unit D including installation of new exterior lights, removal of beacon lights from the platform, and installation of new communication radio and antennae.

October 28, 2003—Short period of planned downtime for corrective maintenance on Unit D to make the final electrical connections for lighting, radio, and antennae.

December 22, 2003—Shortly after restarting Unit D following a routine preventive maintenance, the unit shut down because the manifold temperature timer did not allow enough time to bring the extraction-well air up to temperature during sub-zero ambient temperatures. Adjustments were made to the timer, and the unit was restarted the following day.

2.7.2 Preventive Maintenance

A preventive maintenance schedule has been developed to ensure that appropriate measures are taken to maximize the life of system components. The preventive maintenance schedule identifies maintenance activities to be completed at monthly, quarterly, semiannual, annual, and biannual intervals (McMurtrey and Harvego 2001). Maintenance work is planned by qualified project field personnel and executed by RWMC craft personnel. Development and implementation of preventive maintenance work packages conform to the INEEL "Integrated Work Control Process" (STD-101). Project field personnel continue to make improvements on the maintenance work packages to minimize downtime of the VVET units.

During the 2003 end-year reporting cycle, preventive maintenance tasks were performed on Units A and D. Monthly preventive maintenance tasks were performed on Unit A from July through September. Monthly preventive maintenance was performed on Unit D during the reporting period. A quarterly preventive maintenance task was performed on Unit D in July, September, and December 2003. A semiannual preventive maintenance task was performed on Unit D in July and December 2003. An annual preventive maintenance task was performed on Unit D in July 2003.

2.7.3 Configuration Management

The configuration management process provides quick access to a database of information about individual components and pieces of equipment including the manufacturer model and serial numbers, contact address and phone numbers, and all pertinent information for repairing or replacing any component or part. The database also provides a numbering system to identify the equipment and components in the field when performing preventive maintenance or other work activities.

2.7.4 Calibration Program

Instrument calibrations are completed at regular intervals to maximize the quality of operations data and the confidence with which these data can be applied to make judgments relative to process performance. Annual calibration is required of only the primary flow element in each system. The primary flow elements will undergo an annual performance check that will use a calibrated hotwire anemometer for in situ flow verification. Calibration of other process indicators including wellhead flow meters, temperature elements, and pressure transmitters is not required.

2.7.5 Installation of Unit F

The flameless thermal oxidation VVET units (designated as Units A, B, and C) have operated since the mid-1990s and are now past their design lifetimes. To enhance the efficiency and rate of removal of VOCs from the subsurface, flameless thermal oxidation units are being replaced with electrically heated catalytic oxidizing VVET units (designated as Units D, E and F). During 2001, Unit C was decommissioned and replaced with Unit D. Likewise, Units A and B were decommissioned during 2003 and are being replaced with Units E and F, respectively. During the end-year 2003 operational period, extensive site preparation, unit manufacture, installation, and testing activities were performed to prepare for deployment of the new Units E and F. Both units were shipped to the INEEL, and work is in progress to launch the units into operational status early in 2004.

2.7.6 Radiological Filter Sampling and Analysis at the Inlet to Vapor Vacuum Extraction with Treatment Units

Weekly radiological surveys were completed on inlet filters downstream of the blowers at each of the VVET units. Results indicate that radiological contamination is not present on the filters.

2.7.7 Operations and Maintenance Plan Revision

A complete revision to the Operations and Maintenance Plan for OU 7-08 (McMurtrey and Harvego 2001) has been initiated to incorporate changes associated with the drilling of new extraction wells, decommissioning of Units A and B, and installation and startup of Units E and F. This revision includes new preventive maintenance procedures, operating procedures, technician qualification checklists, spare parts lists, and system drawings. This update will (1) ensure accurate documentation of the oxidizer operating parameters and operations and maintenance procedures to extend oxidizer life to the extent possible, and (2) optimize process efficiency and operational safety. The revised Operations and Maintenance Plan for OU 7-08 will be completed and released in the spring of 2004.

2.8 Operational Uptime

During the end-year 2003 operations period, a goal of 80% uptime of available hours was set for operation of the VVET units, not including planned and uncontrollable downtime for maintenance activities. An uncontrollable downtime is defined as a circumstance clearly outside the control of the project that causes the operation of the units to be disrupted. This does not include situations of equipment or component failure, but conditions where no amount of planning on the part of the project could have avoided the downtime (e.g., inclement weather causing a power outage).

Appendix E presents the operations history of VVET Units A and D, when calendar hours operated for Unit A were 2,073 and Unit D were 4,416. Unit A had 1,897 and Unit D had 4,219 available operational hours during the reporting period. Unit A operated 1,897 hours (92% of calendar hours, 100% of available hours) between July 1 and September 25, at which time it was permanently shut down. Unit D ran for 4,200 hours (95.1% of calendar hours, 99.5% of available hours) between July 1 and December 31, 2003.

2.8.1 Planned and Uncontrollable Downtime

Available hours equal calendar hours less planned and uncontrollable downtimes. The majority of downtimes occurring during the end-year 2003 operations period were classified as planned downtimes. Planned downtimes included scheduled maintenance activities (corrective and preventive) and system optimizations. Dates and brief explanations of activities that resulted in planned operational shutdowns are itemized below.

- June 12, 2003–July 4, 2003—Planned downtime at Units A and D to install the high-voltage power line and equipment to support operation of Unit F. During the power outage, the project took advantage of the downtime and performed monthly, quarterly, semiannual, and annual preventive maintenance.

- July 15, 2003—Planned downtime at Unit D to complete quarterly preventive maintenance.

- July 22, 2003—Uncontrollable downtime on both Units A and D when power was lost because of a blown fuse on the main power pole.

- September 10, 2003—Planned downtime at Unit D to complete quarterly preventive maintenance.

- September 12–15, 2003—Uncontrollable downtime on both Units A and D due to a power outage caused by blown fuses on the main power pole.

- September 29, 2003—Planned downtime at Unit D to disconnect power at the sectionalizer to support deactivation at Unit A. Unit A was shutdown permanently on September 25, 2003.

- October 22, 2003—Planned downtime at Unit D for corrective maintenance including installation of exterior lights, radio, and antennae.

- October 28, 2003—Short period of planned downtime at Unit D for corrective maintenance to make the final electrical connections for lighting, radio, and antennae.

- December 22, 2003—Planned downtime at Unit D to complete quarterly and semiannual preventive maintenance.

2.8.2 Unplanned Downtime

Through the operational period, Unit A had no unplanned downtime, and Unit D had one unplanned downtime totaling 18.8 hours. This downtime occurred on December 23, 2003, because the manifold temperature timer did not allow enough time to bring the extraction-well air up to temperature during sub-zero ambient temperatures. Adjustments were made to the timer to correct the problem.

3. WELL MONITORING

The *Volatile Organic Compound Vapor Monitoring Results from Selected Wells at the Radioactive Waste Management Complex* (Housley 2003) contains all data collected from the monitoring wells from 1993 through 2002. Starting in 2003, these data are updated and presented within the environmental and operational semiannual data reports and will contain data from the previous 6 months of monitoring. Table 3 shows the project and official names of the 58 wells presented in this report. Figure 3 shows the depths of the ports of each well. Figure 4 shows the location of each monitoring well in and around the RWMC.

Appendix F presents VOC concentrations of subsurface vapor samples collected from July through December 2003. The samples were collected from well ports located inside and in close proximity to the SDA.

Table 3. Organic contamination in the vadose zone wells listed by official name and project name.

Inside the Subsurface Disposal Area		Outside the Subsurface Disposal Area	
Official Name	Project Name	Official Name	Project Name
RWMC-VVE-V-067	1E	DE8	DE8
RWMC-VVE-V-068	2E	VVE1	VVE1
RWMC-VVE-V-069	3E	VVE3	VVE3
RWMC-VVE-V-070	4E	VVE4	VVE4
RWMC-VVE-V-071	5E	VVE6A	VVE6
RWMC-GAS-V-072	1V	VVE7	VVE7
RWMC-GAS-V-073	2V	VVE10	VVE10
RWMC-GAS-V-074	3V	M1SA	M1S
RWMC-GAS-V-075	4V	M3S	M3S
RWMC-GAS-V-076	5V	M4D	M4D
RWMC-GAS-V-077	6V	M6S	M6S
RWMC-GAS-V-078	7V	M7S	M7S
RWMC-GAS-V-079	8V	M10S	M10S
RWMC-GAS-V-080	9V	SOUTH-1835	M10S-R
RWMC-GAS-V-081	10V	SOUTH-MON-A-001	M11S
88-01D	8801	SOUTH-MON-A-003	M13S
89-02D	8902	SOUTH-MON-A-004	M14S
9301	9301	SOUTH-MON-A-009	M15S
9302	9302	SOUTH-MON-A-010	M16S
RWMC-VVE-V-163	DE1	RWMCMON-A-162	M17S
IE3	IE3	SOUTH-1898	1898
DE3	DE3	SOUTH-GAS-V-005	OCVZ11
IE4	IE4	SOUTH-GAS-V-007	OCVZ13
DE4	DE4	SOUTH-GAS-V-008	OCVZ14
IE6	IE6	USGS 118	USGS118
DE6	DE6	WWW1	WWW1
IE7	IE7	77-1	77-1
DE7	DE7	78-4	78-4
IE8	IE8	D0-2	D02

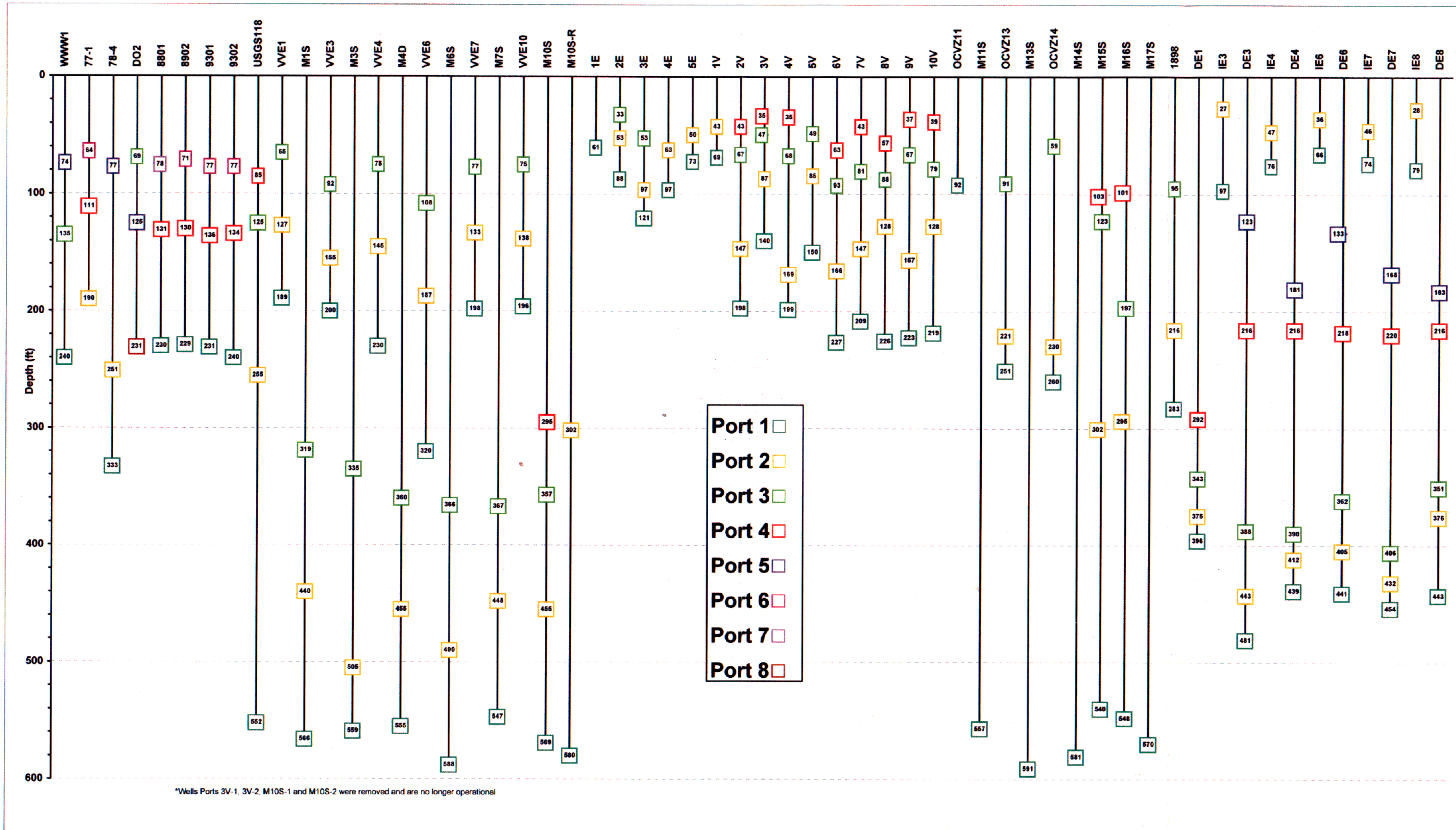

Figure 3. Port depths of the Operable Unit 7-08 monitoring wells.

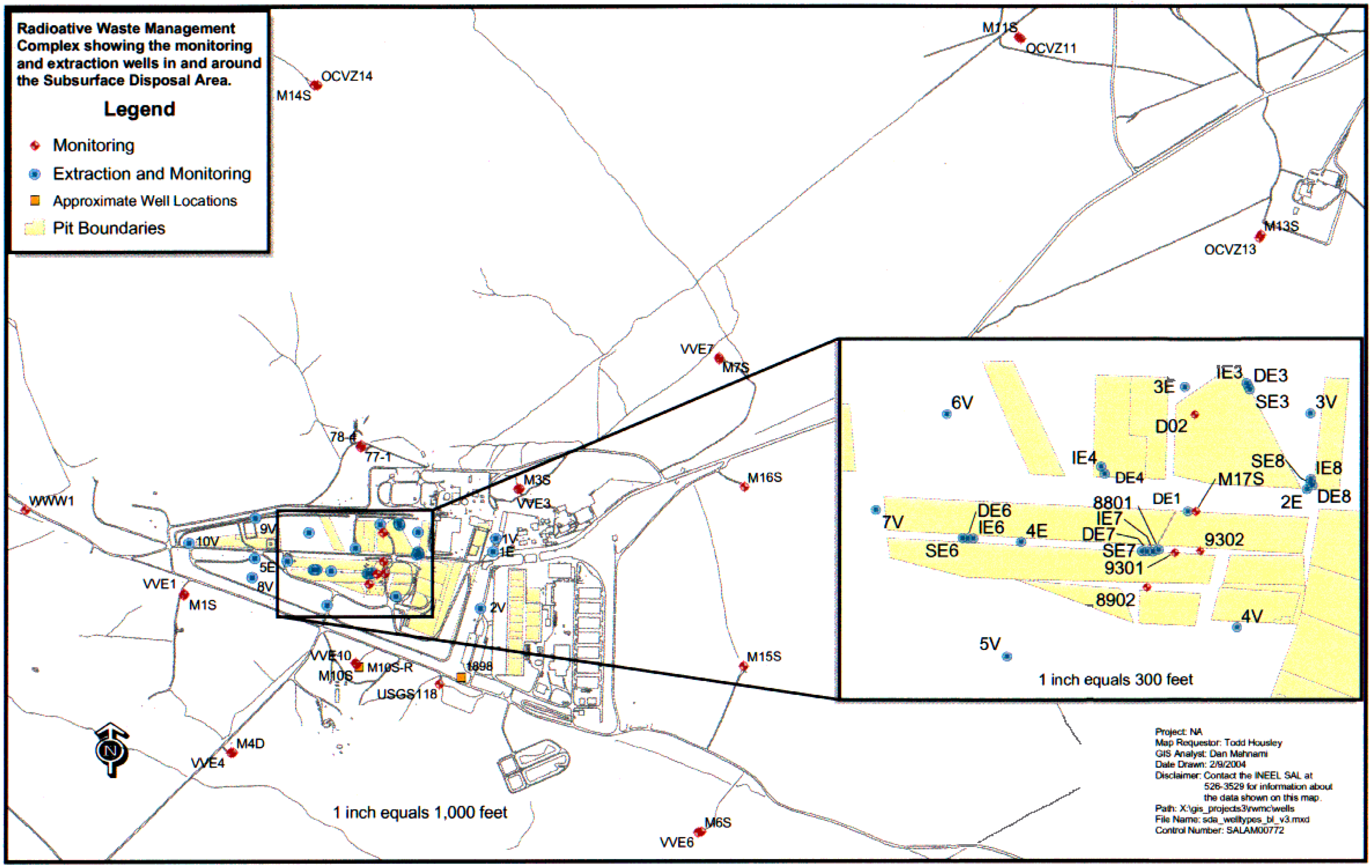

Figure 4. Operable Unit 7-08 vapor monitoring and extraction wells inside and outside the Subsurface Disposal Area.

4. CONCLUSION

Data quality and monitoring objectives include completeness, precision, and accuracy as outlined in the OCVZ DQO report. The target for completeness was generally met. To date, Unit D is operating and removing VOC mass from the RWMC subsurface. General trends show a decreasing areal extent of the plume of VOCs. Occasionally, short-term, intermittent increases of VOC concentrations are observed at various locations and depths around the SDA. These increases are often sporadic and difficult to explain. The prevailing long-term trends, however, indicate that overall VOC concentrations are decreasing above the 34-m (110-ft) interbed when compared to data taken before operations at the same depth.

5. REFERENCES

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